ZooKeys 955: 1–13 (2020)
doi: 10.3897/zookeys.955.48766
https://zookeys.pensoft.net

RESEARCH ARTICLE

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Taxonomic study of the genus *Unkanodes* (Hemiptera, Fulgoroidea, Delphacidae) from Pakistan, with description of a new species

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Academic editor: M. Wilson | Received 25 November 2019 | Accepted 14 September 2020 | Published 18 November 2020

http://zoobank.org/653D2AC5-68B0-4D6A-95B9-828ACB477E07

Citation: Sohail K, Naveed H, Qin D, Zhang Y (2020) Taxonomic study of the genus *Unkanodes* (Hemiptera, Fulgoroidea, Delphacidae) from Pakistan, with description of a new species. ZooKeys 955: 1–13. https://doi.org/10.3897/zookeys.955.48766

Abstract

Unkanodes (*Kwonianella*) *malamjabbensis* **sp. nov.** (Hemiptera, Delphacidae) is described and illustrated and *U. latespinosa* (Dlabola, 1957) is newly recorded from Malamjabbah, Swat, Pakistan. These two species represent the first records of the genus *Unkanodes* Fennah, 1956 from Pakistan. A key to the world's species of the genus *Unkanodes* is provided.

Keywords

Distribution, Fulgoromorpha, key, morphology, taxonomy

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Introduction

The planthopper family Delphacidae currently consists of 2217 species in 427 genera (Bourgoin 2020). Delphacids are small insects that can be easily distinguished by the presence of a large, movable spur (the "calcar") at the apex of the hind tibiae (Bartlett 2014). Most delphacids are grass-feeders, although some feed on other monocots such as sedges and rushes, and some feed on dicots (Bartlett 2019). A number of species feed on economically important crops, such as sugarcane, maize and rice (Wilson and O'Brien 1987; Wilson et al. 1994). The plant order Poales accounts for more than 70% of their hosts, while all other plant orders provide only 3%. In the Poales group, the family Poaceae has the highest (52%) percentage of hosts, followed by Cyperaceae (16.5%), while the remaining families account for only 3% of host records (Bourgoin 2020).

The delphacid fauna of Pakistan has been poorly studied, with only ten species previously recorded from this country (Bourgoin 2020). This figure, consisting of about 0.4% of the world's described species, likely largely underrepresents the actual diversity of delphicids in this country. The genus *Unkanodes* was established by Fennah (1956) with the type species *Unkanodes sapporona* (Matsumura, 1935) from Che-Kiang (Zhejiang Province of China). Currently, this genus comprises nine species (Bartlett 2019) occurring in Afghanistan, Alaska, Austria, China, Denmark, Estonia, Finland, Germany, Greece, Iran, Japan, Lithuania, Mongolia, Poland, Russia, South Korea, Sweden, Taiwan, Turkey, Ukraine, Yugoslavia, and the U.S.A. (Bourgoin 2020). The genus *Unkanodes* is economically important and its members are vectors of many diseases in rice and cereals and also the causative agents of hopper burn diseases. *Unkanodes albifascia* is responsible for transmission of NCMV (Northern cereal mosaic virus), RBSDV (Rice black-streaked dwarf virus) and stripe disease. *Unkanodes sapporona* is involved in the transmission of NCMV, RSV (Rice stripe tenuivirus), and RBSDV. *Unkanodes tanasijevici* is reported to be a vector of IMMV (Iranian Maize Mosaic Nucleorhabdovirus), MIMV (Maize Iranian Mosaic Virus), MRDV (Maize Rough Dwarf Fiji Virus), and RBSDV (Bartlett 2019).

In this study, *U.* (*Unkanodes*) *latespinosa* (Dlabola, 1957) is recorded for the first time from Pakistan and a new species *U.* (*Kwonianella*) *malamjabbensis* sp. nov., is described.

Materials and methods

Specimens were collected from Pakistan and deposited at the Entomological Museum of Northwest A&F University (**NWAFU**) Yangling, Shaanxi, China. Morphological terminology follows Asche (1985), Wilson (2005) and Bartlett et al. (2014). The method for genitalia preparation and clearing follows Wilson and McPherson (1980) and Wilson (2005). Morphological characters were observed using the stereomicroscope Olympus SZX10. Measurements of characters are given in millimeters (mm). Photographs of the adults were taken using a Zeiss AxioCam ICc 5. Adobe Photoshop was used for labeling and plate composition of the obtained images.

Taxonomy

Family Delphacidae Leach, 1815
Subfamily Delphacin.ae Leach, 1815
Tribe Delphacini Leach, 1815

Genus *Unkanodes* Fennah, 1956

Unkanodes Fennah, 1956.
Unkanodes sapporona (Matsumura, 1935), comb. by Fennah 1956: 474.

Type species. *Unkana sapporona* Matsumura, 1935: 131, by original designation.

Diagnosis. Relatively slender, head slightly narrower than pronotum. Vertex longer than broad, its width at base not exceeding width of an eye, shallowly rounded at apical margin; carinae of vertex and frons distinct. Frons parallel-sided, about 2.0–2.5 times as long as wide, lateral margins parallel, narrowing upwards in apical 1/3; median carina of frons bifurcates near fastigium. Lateral carinae of pronotum diverging, vanishing before reaching posterior margin. Calcar with 10–20 well-developed teeth; apical tooth separate from the remaining teeth. Posterior margin of pygofer with a cut on the sides. Segment X (anal tube) with a pair of teeth or teeth absent. Styli flattened, diverging or more or less parallel beyond middle, with complex apices, zigzag-shaped bent and wide or narrowed and slanting outwards. Armature of diaphragm (bridge of pygofer) bearing a pair of teeth directed upwards or a projection with 2 apices. Aedeagus more or less straight, or bent ventrad, elbow-shaped, slightly asymmetrical due to location of gonopore and arrangement of teeth on aedeagal shaft (after Fennah 1956 and Anufriev and Emeljanov 1988).

Checklist of species of the genus *Unkanodes* Fennah

Subgenus *Unkanodes* (*Chilodelphax* Vilbaste, 1968)
Unkanodes* (*Chilodelphax*) *silvaticus Vilbaste, 1968
Unkanodes silvaticus Vilbaste, 1968: 24.
Chilodelphax silvaticus (Vilbaste, 1968); comb. by Kwon 1982: 4.
Unkanodes (*Chilodelphax*) *silvaticus* Vilbaste, 1968; comb. by Anufriev and Emeljanov 1988: 409.

Subgenus *Unkanodes* (*Unkanodes* Fennah, 1956)
Unkanodes* (*Unkanodes*) *excisa (Melichar, 1898)
Liburnia excisa Melichar, 1898: 67.
Delphax excisa (Melichar, 1898); comb. by Puton 1899: 108.
Liburnia elymi Jensen-Haarup, 1917: 3; syn. by Jensen-Haarup 1920: 53.
Delphacodes excisa (Melichar, 1898); comb. by Metcalf 1943: 436.
Elymodelphax excisa (Melichar, 1898); comb. by Wagner 1963: 167.
*Unkanodes excis*a (Melichar, 1898); comb. by implication Dlabola 1965: 86.

Unkanodes* (*Unkanodes*) *latespinosa (Dlabola, 1957)
Calligypona latespinosa Dlabola, 1957.
Unkanodes latespinosa (Dlabola, 1957), comb. apparently by Dlabola 1964: 240 (see also Dlabola 1967: 53; Emeljanov 1977: 113).
Unkanodes* (*Unkanodes*) *paramarginata (Dlabola, 1961: 275)
Unkanodes* (*Unkanodes*) *sapporona (Matsumura, 1935)
Unkana sapporona Matsumura, 1935.
Unkanodes sapporona (Matsumura, 1935), comb. by Fennah 1956: 474.
Unkanodes* (*Unkanodes*) *tanasijevici (Dlabola, 1965)
Elymodelphax tanasijevici Dlabola, 1965.
Calligypona zeravshanica Dubovsky, 1967; syn. by Emeljanov 1982: 98.
Ribautodelphax notabilis Logvinenko, 1970

Subgenus *Unkanodes* (*Kwonianella* Anufriev, 1988)
Unkanodes* (*Kwonianella*) *albifascia (Matsumura, 1900: 268)
Liburnia albifascia Matsumura, 1900: 268.
Delphax albifascia (Matsumura, 1900); comb. by Oshanin, 1907: 330.
Delphacodes albifascia (Matsumura, 1900); comb. by Metcalf 1943: 400.
Unkanodes (*Chilodelphax*) *albifascia* (Matsumura, 1900); comb. by Vilbaste 1968: 26.
Chilodelphax albifascia (Matsumura, 1900); status by Kwon 1982: 4.
Unkanodes (*Kwonianella*) *albifascia* (Matsumura, 1900); comb. by Anufriev and Emeljanov 1988: 409.
Unkanodes* (*Kwonianella*) *insularis Anufriev, 1988
Unkanodes (*Kwonianella*) *insularis* Anufriev & Emeljanov, 1988: 409.
Unkanodes* (*Kwonianella*) *sympaticus Anufriev, 1988
Unkanodes (*Kwonianella*) *sympaticus* Anufriev & Emeljanov, 1988: 409.

Key to subgenera and species of *Unkanodes* of the world

This key is modified from Anufriev and Emeljanov (1988). Bartlett and contributors (2017) treated *Ribautodelphax notabilis* Logvinenko, 1970 as a synonym of *Unkanodes tanasijevici* (Dlabola, 1965) based on Nast (1987). In the present key, characters mentioned for *U. tanasijevici* are from the description of Ding (2006). *Unkanodes* (*Unkanodes*) *paramarginata* is not included in the key due to limited literature.

1 Armature of diaphragm with a pair of teeth slanting upwards or directed back; genital style with relatively wide apices; segment X (anal tube) with large widely-spaced processes; sub genus *Unkanodes* (*Unkanodes*) **2**
– Armature of diaphragm without teeth or with a tooth bifurcate at apex; genital style with narrow apices; segment X (anal tube) with or without such processes **5**
2 Process of anal tube spaced more widely, weakly or strongly diverging; genital style with strong subapical lobe, apex wider **3**

– Processes of anal tube spaced less widely, more or less parallel; genital style with weak subapical lobe, apex narrower (Anufriev and Emeljanov 1988: fig. 310: 1–12) ..... ***U.* (*Unkanodes*) *excisus***

3 Process of segment X widely spaced weakly diverging; apex of genital style relatively wider (Anufriev and Emeljanov 1988: fig. 310: 13–17) ..... ***U.* (*Unkanodes*) *sapporona***

– Process of segment X widely-spaced strongly diverging; apex of genital style comparatively less wider..... **4**

4 Aedeagus elbow-shaped; process of segment X posteroventrally curved (Figs 6–11)..... ***U.* (*Unkanodes*) *latespinosa***

– Aedeagus straight with a strong tooth on dorsal aspect, ventrally with a weak lobe below the tooth; segment X not curved (Ding 2006: fig. 338A–L)..... ***U.* (*Unkanodes*) *tanasijevici***

5 Dorsal and posterior margin of pygofer forming an obtuse angle in lateral view; segment X (anal tube) with large widely-spaced teeth; apical half of aedeagus straight; subgenus *Chilodelphax* (Anufriev and Emeljanov 1988: fig. 311: 1–15)..... ***U.* (*Chilodelphax*) *silvaticus***

– Dorsal and posterior margin of pygofer forming an acute angle in lateral view; segment X (anal tube) without or with narrowly spaced teeth; apical half of aedeagus directed dorsad (Anufriev and Emeljanov 1988); subgenus *Kwonianella*..... **6**

6 Process of pygofer bridge very short, directed downwards, sometimes bifurcate at apex; genital style comparatively short with wide subapical lobe..... 7

– Process of pygofer bridge slightly long, bifurcated and directed backwards; genital style longer with narrow subapical lobe or short with wide subapical lobe..... **8**

7 Aedeagus near bent with a pair of long teeth perpendicular to shaft, the length of aedeagus matches with thickness of shaft (Anufriev and Emeljanov 1988: fig. 312: 17–19) ..... ***U.* (*Kwonianella*) sympatricus**

– Aedeagus near bent without long teeth, the length of which matches with thickness of the shaft (Anufriev and Emeljanov 1988: fig. 312: 1–11) ..... ***U.* (*Kwonianella*) *albifascia***

8 Aedeagus narrowing abruptly in apical 1/3, with a lobe-like process on ventral aspect in lateral view (Fig. 21) ..... ***U.* (*Kwonianella*) *malamjabbensis* sp. nov.**

– Aedeagus not narrowing abruptly in apical 1/3, without a lobe on ventral aspect in lateral view (Anufriev and Emeljanov 1988: fig. 312: 12–16) ..... ***U.* (*Kwonianella*) *insularis***

Unkanodes (*Unkanodes*) *latespinosa* (Dlabola, 1957)

Figs 1–11

Remarks. Dlabola (1957) described this species based on specimens from Afghanistan and provides a detailed description. It can be distinguished from other species of *Unkanodes* by the large, widely-spaced processes of segment X (anal tube) and elbow-shaped aedeagus.

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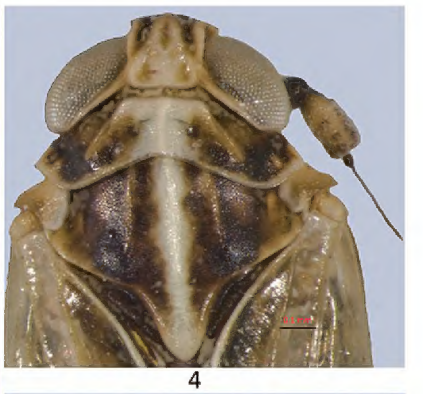

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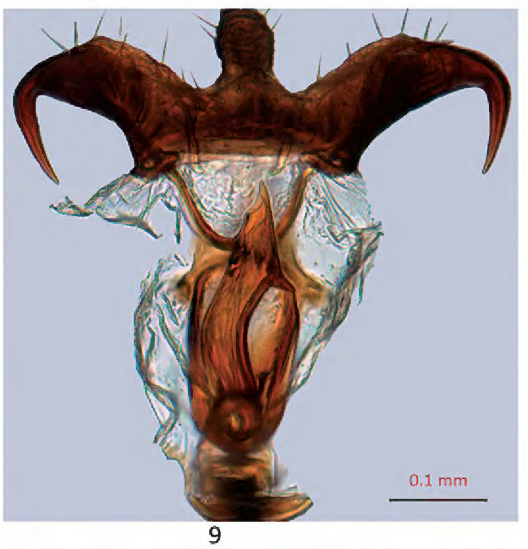

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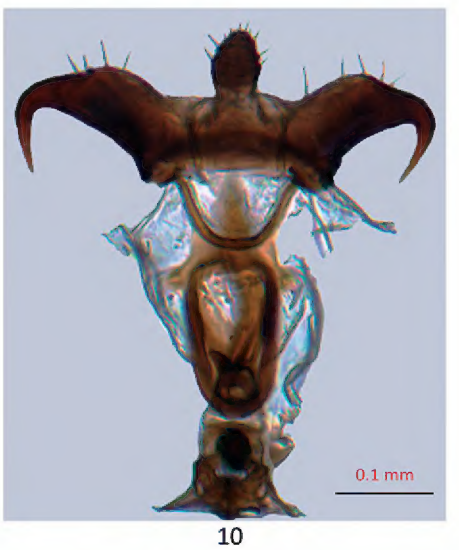

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Figures 1–11. *Unkanodes* (*Chilodelphax*) *latespinosa* (from Pakistan) **1** adult, dorsal view (macropterous) **2** adult, same species (brachypterous) **3** adult (macropterous), lateral view **4** vertex, pronotum and mesonotum, dorsal view **5** frons, ventral view **6, 7** male genitalia, caudal and lateral views **8–10** anal segment and aedeagus, lateral, dorsal and ventral views **11** genital style, lateral view.

Material examined. 3♂♂ (brachypterous), 7♂♂ (macropterous) Malamjabbah, Swat-Khyber Pakhtunkhwa, Pakistan, 35°13'21.76"N, 72°25'32.93"E, 2993.39 m, 5 vii 2018, sweeping grasses, coll. Kamran Sohail. The area has a very diverse habitat for fruits and vegetables, and this species was collected in grasses near vegetable fields. This species is newly recorded for the fauna of Pakistan.

Distribution. Previously recorded from Afghanistan, Iran, Mongolia, Turkey and Yugoslavia. In this study it is recorded from Swat, Khyber Pakhtunkhwa-Pakistan.

***Unkanodes* (*Kwonianella*) *malamjabbensis* sp. nov.**

http://zoobank.org/A9EFB5A5-AD3B-41B6-8599-94F3A4B3AC49

Description. Length of male (n=2) 1.4–1.6 mm.

Colour. General body colour dark brown to black. Vertex pale, compartments with three distinct yellow spots. Carina on frons pale, intercarinal region dark brown, gena concolourous with intercarinal region, compound eyes greyish. Antenna yellowish slightly darker at junction of scape and pedicel. Pronotum and mesonotum medially with a white stripe; darker at adjoining areas, extreme lateral margins and median carina white, lateral carina concolourous with adjoining regions. Forewings dark brown to black, apical and anal margins pale. Legs yellowish, spines with black apices. Abdominal tergites darker, segments IX and X lighter, pygofer brown.

Structure. Head narrower than pronotum, eyes extending beyond posterior margin of vertex (Figs 12, 14). Vertex ca. 2X longer than wide; stem of Y-shaped carina of vertex obsolete, lateral and posterior margins distinct, arms of submedian carina meeting at fastigium (Fig. 14). Frons parallel-sided; widest near basal 1/4 of eyes, narrower in apical 1/3, median carina bifurcate near fastigium (Fig. 15). Antennal scape about as long as wide, ca 1/2 x length of pedicel, pedicel bearing many sensory pits arranged in longitudinal rows dorsally from base to apex (Figs 13, 15). Frontoclypeal suture distinct, slightly arched; median carina on postclypeus visible, rostrum elongate, reaching hind coxae (Fig. 15). Pronotum much wider than long at midlength; lateral carinae strongly diverging, vanishing before reaching posterior margin and not in line with mesonotal lateral carinae, anterior margin straight at vertex, posterior margin slightly concave medially (Fig. 14). Mesonotum tricarinate, subequal to length of pronotum; median carina not extending to apex of scutellum, lateral carinae slightly diverging reaching hind margin, tegula inconspicuous (Fig. 14). Forewing covering only half of abdomen; veins granulate (Figs 12, 16). Metatibiae with two lateral spines on shaft, first near tibiofemoral articulation, second after middle. Metatibial spur tectiform, distally narrowed bearing row of 18 black-tipped teeth on outer margin, inner margin straight (Fig. 17). Spinal formula of hind leg 5/7/4.

Male genitalia. In caudal view, pygofer wider than long widest at mid length, dorsolaterally nearly straight (Figs 18, 20); diaphragm armature well-developed, V-shaped, pair of lobes located near the parameres directed upwards, pygofer bridge bearings two

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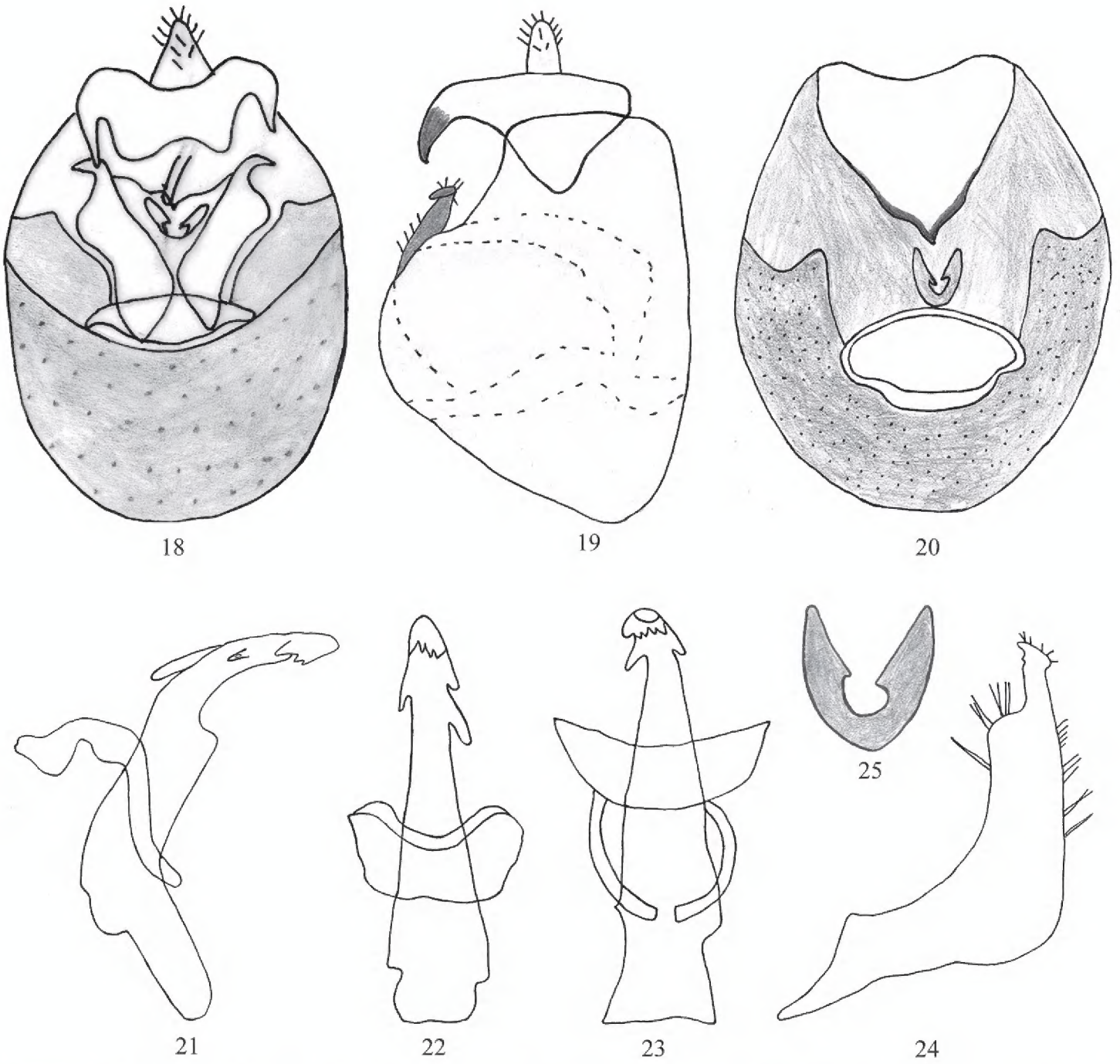
Figures 12–17. *Unkanodes* (*Kwonianella*) *malamjabbensis* sp. nov. **12, 13** adult, dorsal and lateral views **14** head and thorax, dorsal view **15** frons, ventral view **16** forewing **17** metatibial spur.

distinct tooth-like processes widely diverging, directed backwards forming blunt apex (Fig. 20). In lateral view, anterior margin nearly straight gradually arched apically, dorsal and posterior margins acutely rounded (Fig. 19). Segment X (anal tube) bearing



Figures 18–25. *Unkanodes* (*Kwonianella*) *malamjabbensis* sp. nov. **18, 19** male genitalia, caudal and lateral view **20** pygofer, caudal view **21** aedeagus, lateral view **22, 23** same, dorsal and ventral views **24** genital style, lateral view **25** medioventral process of armature of diaphragm.

large, widely spaced posteroventrally curved acute processes (Figs 18, 19). Parameres longer than wide, apically narrow, subapical lobe wider, posterior margin straight (Fig. 24). Aedeagus elongate and narrow, basal 1/3 straight, bent gradually forming an obtuse angle, apical 1/3 gradually curved ventrad (Fig. 21); in lateral view, with lobe or hump-like process on ventral aspect, with a large tooth just above the lobe on the dorsal aspect (Fig. 21). Suspensorium angling circled laterally, apically wider (Figs 22, 23).

Type materials. ***Holotype*:** ♂ Malamjabbah, Swat-Khyber Pakhtunkhwa, Pakistan, 35°13'21.76"N, 72°25'32.93"E, 2993.39 m, 5 vii 2018, sweeping grasses, coll. Kamran Sohail. Paratype: 1♂, same data as holotype.

Remarks. This new species was collected in a grass habitat near ponds. The Type locality is an understudied habitat for fulgoroids and the region reflects a true diversity of planthoppers for future prospects.

Female. Unknown.

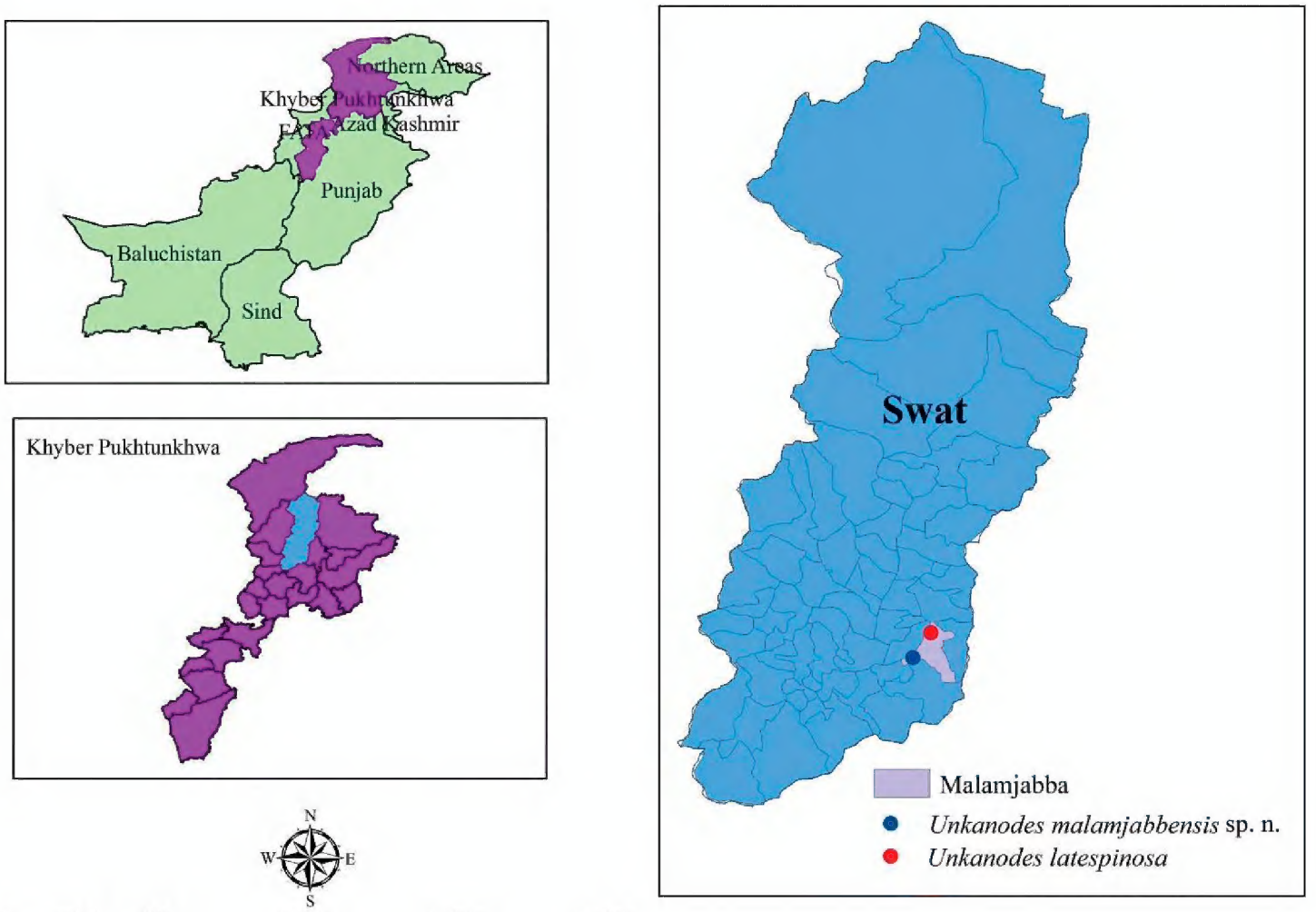


Figure 26. Distribution map of species of *Unkanodes* in Pakistan.

Etymology. The new species is named after the type locality 'Malamjabba'.

Diagnosis. The new species is externally similar to *U.* (*Kwonianella*) *albifascia* which also has a white stripe on the thorax and median margins of the forewings. However, it can be separated by the distinctly separated process of the pygofer bridge, widely diverging in *U.* (*Kwonianella*) *malamjabbensis* sp. nov. but very short and bifurcate at the apex in *U.* (*Kwonianella*) *albifascia* (Anufriev and Emeljanov 1988, Figs 2, 6; p. 412); and apical half of aedeagus gradually curved ventrad bearing a lobe-like process on the ventral aspect in *U.* (*Kwonianella*) *malamjabbensis* sp. nov. versus the apical half of the aedeagus slanting dorsad without a lobe in *U.* (*Kwonianella*) *albifascia* (Anufriev and Emeljanov 1988, Fig. 4; pp. 409, 412). *Unkanodes* (*Kwonianella*) *malamjabbensis* sp. nov. is also close to *U.* (*Kwonianella*) *insularis* Anufriev and *U.* (*Kwonianella*) *sympatricus* Anufriev in external appearance but can be distinguished by the distinct shapes of the aedeagus and parameres.

Acknowledgements

We are sincerely thankful to Stephen W. Wilson (Professor Emeritus of Biology at University of Central Missouri Warrensburg, USA) for revising and providing comments on an early draft of this manuscript. We are also thankful to Prof. John Richard SCHROCK (Emporia State University, USA) for English revision of this manuscript

and Dr. Tehseen Javed (College of Water Resources and Architecture Engineering, NWAFU) for providing the distributional map. We also extend our thanks to anonymous reviewers and the editor for their valuable suggestions and comments. This study was supported by the National Natural Science Foundation of China (31420103911) and The Ministry of Science and Technology of the People's Republic of China (2005DKA21402).

References

Anufriev GA, Emeljanov AF (1988) Volume II: Homoptera and Heteroptera. In: P.A. Lehr (ed.). Keys to the Insects of the Far East of the USSR in Six Volumes, Transliteration of the Russian title: Opredelitel' nasekomykh Dal'nego Vostoka SSSR v shesti tomakh (Vol. 2). Ravnokrylye i poluzhestkokrylye. In: Lehr PA (Ed.) Keys to the Insects of the Far East of the USSR in Six Volumes. Nauka, Leningrad.

Asche M (1985) Zur Phylogenie der Delphacidae Leach, 1815 (Homoptera: Cicadina: Fulgoromorpha). Marburger Entomologische Publikationen 2(1), Vols. 1–2: 1–398. [399–910.]

Bartlett CR (2019) [and updates] Planthoppers of North America. [accessed on 30th October 2019] https://sites.udel.edu/planthoppers/

Bartlett CR (2014) New species of the planthopper genus *Parkana* (Hemiptera: Fulgoroidea: Delphacidae) from Mesoamerica. Transactions of the American Entomological Society 140: 185–208. https://doi.org/10.3157/061.140.0112

Bartlett CR, O'Brien LB, Wilson SW (2014) A review of the planthoppers (Hemiptera: Fulgoroidea) of the United States. Memoirs of the American Entomological Society 50: 1–287.

Bourgoin T (2020) FLOW (Fulgoromorpha Lists On the Web): a world knowledge base dedicated to Fulgoromorpha. Version 8, updated 16th January 2020. http://hemiptera-databases.org/flow/ [accessed 21st January 2020]

Ding JH (2006) Fauna Sinica Insecta (Vol. 45). Homoptera Delphacidae. Science Press, Beijing.

Dlabola J (1957) Die Zikaden Afghanistans (Homoptera Auchenorrhyncha) nach der Ergebnisse der von Herrn J. Klapperich in den Jahren 1952–1953 nach Afghanistan untergenommenen Expedition. Mitteilungen der Münchner Entomologischen Gesellschaft 47: 265–303.

Dlabola J (1961) Die Zikaden von Zentralasien, Dagestan und Transkaukasien (Homopt. Auchenorrhyncha). Acta Faunistica Entomologica Musei Nationalis Pragae 34(587): 241–358.

Dlabola J (1964) Die Zikaden Afghanistans (Homoptera Auchenorrhyncha) II Teil. Ergebnisse der Sammelreisen von Dr. H. G. Amsel, G. Ebert, Dr. Erichson, J. Klapperich und Dr. K. Lindberg. Mitteilungen der Münchner Entomologischen Gesellschaf 54: 237–255.

Dlabola J (1965) Ergebnisse der zoologischen Forschungen von Dr. Z. Kaszab in der Mongolei. 54 Homoptera-Auchenorrhyncha. Acta Faunistica Entomologica Musei Nationalis Pragae 11(100): 79–136.

Dlabola J (1967) Ergebnisse der 1. mongolisch-tschechoslowakischen entomologisch-botanischen Expedition in der Mongolei. Nr. 3: Homoptera, Auchenorrhyncha (Erganzung). Acta Faunistica Entomologica Musei Nationalis Pragae 12(118): 51–102.

Dubovsky GK (1967) Novye vidy cikadovykh (Auchenorrhyncha) iz Uzbekistana in Poleznye i vrednye bezpozvonochnye zhivotnye Uzbekistana, Tashkent, 56–59. [*Calligypona zeravshanica* Dubovsky, 1967]

Emeljanov AF (1977) Leaf-hoppers (Homoptera, Auchenorrhyncha) from the Mongolian People's Republic based mainly on materials of the Soviet-Mongolian zoological expeditions (1967–1969). Nasekomye Mongolii [Insects of Mongolia] 5: 96–195. [In Russian]

Emeljanov AF (1982) Fulgoroidea (Homoptera) collected in the Mongolian People's Republic by the entomofaunistical group of the Soviet Mongolian complex biological expedition in 1970–1975. Nasekomye Mongolii [Insects of Mongolia] 8: 69–122. [In Russian]

Fennah RG (1956) Fulgoroidea from southern China. Proceedings of the California Academy of Sciences. San Francisco 28(4): 441–527. [474]

Jensen-Haarup AC (1915) Danmarks Cikader. Flora och Fauna 1915: 137–144. [*Liburnia elymi* Jensen-Haarup, 1915]

Jensen-Haarup AC (1920) Cikader. In: Danmarks Fauna Illustrerede Haandbøger over den Danske dyreverden med Statsunderstøttelse udgivne af Dansk Naturhistorisk Forening. G. E. C. Gads, København, 189 pp. [*Liburnia elymi* Jensen-Haarup, 1915]

Kwon YJ (1982) New and little known planthoppers of the family Delphacidae (Homoptera: Auchenorrhyncha). Korean Journal of Entomology 12(1): 1–11.

Leach WE (1815) Entomology. The Edinburgh Encyclopedia 9: 57–172. [125]

Logvinenko VN (1970) New and little-known leafhoppers of the family Delphacidae (Homoptera, Auchenorrhyncha) from Southern regions of the USSR. Entomologicheskoye Obozrenie 49(3): 624–633. [in Russian; *Ribautodelphax notabilis* Logvinenko, 1970]

Matsumura S (1900) Uebersicht der Fulgoriden Japans. Entomologische Nachrichten 26: 257–269.

Matsumura S (1935) Revision of *Stenocranus* Fieb. (Hom.) and its allied species in Japan Empire. Insecta Matsumurana 9: 125–140.

Melichar L (1898) Eine neue Homopteren-Art aus Schleswig-Holstein. Wiener Entomologische Zeitung 17: 67–69. https://doi.org/10.5962/bhl.part.3112

Metcalf ZP (1943) General Catalogue of the Hemiptera. Fascicle IV, Fulgoroidea, Part 3, Araeopidae (Delphacidae). Smith College, Northampton, Massachusetts.

Nast J (1987) The Auchenorrhyncha (Homoptera) of Europe. Annales Zoologici 40(15): 535–661. [*Ribautodelphax notabilis* Logvinenko, 1970]

Oshanin VT (1907) Verzeichnis der palaearktischen hemipteren, mit besonderer berücksichtigung ihrer verteilung im Russischen reiche. II. Band. Homoptera. I. Lieferung. Annuaire du Musée Zoologique de l'Académie Impériale des Sciences de St. Pétersbourg 12: 193–384. https://doi.org/10.5962/bhl.title.12423

Puton A (1899) Homoptera. Am. Serv. (Gulaerostria Zett. Fieb.) Sect. I. Auchenorrhyncha Dumér. (Cicadina Burm.). Catalogue des Hémiptères (Hétéroptères, Cicadines et Psyllides) de la faune Paléarctique. 4e Ed. Bureau de la Société Française d'Entomologie, Caen, 3–121. https://doi.org/10.5962/bhl.title.12421

Vilbaste J (1968) On the Cicadine fauna of the Primosk region. Valgus Publishing, Tallinn, 195 pp. [In Russian, see p. 26]

Wagner W (1963) Dynamische Taxionomie, angewandt auf die Delphaciden Mitteleuropas. Mitteilungen des Hamburger Zoologischen Museums und Instituts 60: 111–180.

Wilson SW (2005) Keys to the families of Fulgoromorpha with emphasis on planthoppers of potential economic importance in the southeastern United States (Hemiptera: Auchenorrhyncha). Florida Entomologist 88: 464–481. https://doi.org/10.1653/0015-4040(2005)88[464:KTTFOF]2.0.CO;2

Wilson SW, McPherson JM (1980) Keys to the planthoppers, or Fulgoroidea of Illinois (Homoptera). Transactions of the Illinois State Academy of Science 73(2): 1–61.

Wilson SW, Mitter C, Denno RF, Wilson MR (1994) Evolutionary patterns of host plant use by delphacid planthoppers and their relatives. In: Denno RF, Perfect TJ (Eds) Planthoppers: their ecology and management. Chapman Hall, New York, 7–45. https://doi.org/10.1007/978-1-4615-2395-6_2

Wilson SW, O'Brien LB (1987) A survey of planthopper pests of economically important plants (Homoptera: Fulgoroidea). In: Wilson MR, Nault LR (Eds) Proceedings of the 2nd International Workshop on Leafhoppers and Planthoppers of Economic Importance. CAB International Institute of Entomology, London, 343–360.